

1. Segment RS is a diameter of a circle with center O. If T is a point on the circle such that angle TRS measures 50° , find the measure of angle OTS.

A) 40° B) 50° C) 60° D) 90° E) none of these

2. Which of the following correctly describes the solutions of the equation $x^3 + x^2 + x = 0$?

A) three real solutions: one rational solution and two irrational solutions
B) three rational solutions
C) one irrational solution and two solutions that are not real
D) one rational solution and two solutions that are not real
E) none of these

3. An athlete travels from point A directly to point B. If he runs $\frac{3}{4}$ of the way, walks $\frac{1}{9}$ of the way, and jogs the last 10 miles, what is the distance from point A to point B?

A) 36 miles B) 45 miles C) 56 miles D) 72 miles E) none of these

4. Find the distance from the point (7, 9) to the line $x - y = 0$.

A) 1 B) $\sqrt{2}$ C) 2 D) 10 E) none of these

5. Given below are three sets of points.

I. $\{(-1, 0), (-2, 1), (-1, 3)\}$

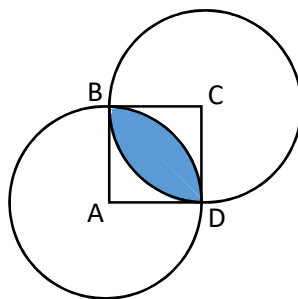
II. $\{(3, -6), (3, -3), (4, -3)\}$

III. $\{(1, 1), (4, 3), (-3, 7)\}$

Which, if any of these sets, represent the vertices of a right triangle?

A) I only B) II only C) II and III only
D) I and II and III E) none of these

6. The square ABCD in the figure has sides of length 1. Both of the circles pass through the points B and D, but one is centered at A and the other at C. What is the area of the intersection of the two circles (the shaded region in the figure)?



- A) $\frac{\pi}{4}$ B) $1 - \frac{\pi}{4}$ C) $\frac{\pi}{2} - 1$ D) $\frac{3\pi}{4} - 1$ E) $\frac{1}{3}$
7. Two women each have two children. The first woman has at least one boy and the second woman's first child is a boy. What are the probabilities for the first woman to have two sons and the second woman to have two sons?

- A) $\frac{1}{2}, \frac{1}{2}$ B) $\frac{1}{4}, \frac{1}{4}$ C) $\frac{1}{3}, \frac{1}{3}$ D) $\frac{1}{3}, \frac{1}{2}$ E) $\frac{1}{2}, \frac{1}{3}$

8. The solution to the system of inequalities:

$$\begin{cases} x + 5y \leq 20 \\ 3x + 2y \leq 21 \end{cases}$$

Is a region with one corner point (x, y) . Give the sum of the coordinates of this corner point.

- A) 0 B) 8 C) 9 D) 41 E) none of these
9. A quadrilateral with two adjacent sides of lengths a and b is given. Assume $a \geq b$ and a and b are integers. Describe the possible lengths of the diagonal that connects the end points of these adjacent sides.
- A) All the integral values strictly between a and b .
 B) All the real values strictly between a and b .
 C) All the real values strictly between $a-b$ and $a+b$.
 D) All the integral values strictly between $a-b$ and $a+b$.
 E) Question cannot be answered with the given information.

10. Each digit on the front panel of a clock is comprised of seven individual LED's in the configuration shown. Each LED may be activated (on) or not (off) according to what digit the configuration is to represent. When activated, an LED glows brightly and forms an individual segment of a digit. A power surge causes the individual LED's to be activated in a random fashion with each segment having a probability of .5 of being activated. Find the probability that the configuration of the LED's that are activated causes an even digit to appear on the panel.

A) $\frac{12}{5}$ B) $\frac{110}{7}$ C) $\frac{510}{7}$ D) $\frac{52}{7}$ E) none of these

11. Find the sum:

$$\frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} + \cdots + \frac{1}{8 \times 9}$$

A) $\frac{52}{63}$ B) $\frac{25}{27}$ C) $\frac{8}{9}$ D) $\frac{7}{72}$ E) None of these

12. A boat is anchored in the middle of a still lake when its fuel tank begins to leak, causing a circular slick on the surface of the lake. If the radius of the slick is growing at a constant rate of 2 ft/min, approximately how much area in sq ft will the slick cover after 1 hour?

A) $120^2\pi$ (B) $60^2\pi$ (C) 120π (D) $240^2\pi$ (E) 240π

13. Let $x = 1 + \frac{1}{2 + \frac{1}{3}}$, $y = 1 + \frac{1}{2 + \frac{1}{3 + \frac{1}{4}}}$, and $z = 1 + \frac{1}{2 + \frac{1}{3 + \frac{1}{4 + \frac{1}{5}}}}$. Which of the following is correct?

A) $x < y < z$ B) $x < z < y$ C) $y < z < x$
 D) $y < x < z$ E) None of these

14. Identify the domain and the range of the following: $y = 3 + \sqrt{x+1}$.

A) D: $x \geq -1$
R: $y \geq 3$

B) D: $x \geq -1$
R: $y \leq 3$

C) D: $x \geq 3$
R: $y \geq 1$

D) D: $x \geq -1$
R: $y \geq 3$

15. The equation $\sqrt{x+5} - \sqrt{x-2} + 1 = 0$ has

A) one real root B) one real root and one complex root

C) two complex roots D) two real roots E) no root

16. The minute hand on Big Ben in London is 8 feet long. What is the arc length traversed by the tip of the minute hand in 38 minutes?

A) $\frac{19\pi}{675}$ ft. B) $\frac{76\pi}{45}$ ft. C) $\frac{76\pi}{15}$ ft. D) $\frac{152\pi}{15}$ ft. E) None of these

17. Find all solutions to the polynomial equation $x^3 + 2x^2 - 19x - 20 = 0$.

A) -5, -1, 4 B) -5, 1, -4 C) 5, -1, 4 D) 5, 1, -4 E) None of these

18. Find the domain of the function $f(x) = \frac{\sqrt{4-x^2}}{x+1}$.

A) $[-2, -1) \cup (-1, 2]$

B) $(-\infty, -2] \cup [2, \infty)$

C) $[-2, 2]$

D) $(-\infty, -1) \cup (-1, \infty)$

E) None of these

19. $\sqrt{\frac{5}{12}} + \sqrt{\frac{1}{5}} \square \sqrt{\frac{1}{3}} + \sqrt{\frac{2}{7}}$

Which relation belongs in the box?

A) $>$

B) $<$

C) $=$

D) $+$

E) $-$

20. Solve $|3x^2 - 2x - 1| \geq 0$

- A) $x \geq 1$ B) $x \leq -\frac{1}{3}$ C) $x \leq -1$ or $x \geq 1$ D) $1 \leq x \leq -0$ E) None of these

21. What is the y coordinate of the hole in the graph of $f(x) = \frac{x^2+4x-12}{x^2-36}$?

- A) $3/2$ B) 1 C) $3/4$ D) 0 E) None of these

22. A number system based on 26 is used and the letters of the alphabet are the digits: A= 0, B= 1, C= 2, D= 3, ... , X= 23, Y= 24, Z= 25. In this system, how much is ONE + ONE?

- A) DBIA B) BAID C) BDAI D) DAIB E) BDIA

23. If $f(x) = \frac{x^4-3x^3+x^2-2}{x-3}$, what is the value of $f(4)$?

- A) 62 B) 70 C) 78 D) 81 E) 90

24. Express $\frac{1}{1-\sqrt{2}}$ in the form $\alpha + \beta\sqrt{2}$, where α and β are rational numbers.

- A) $1 - \sqrt{2}$ B) $-1 - \sqrt{2}$ C) $-\frac{1}{3} - \frac{\sqrt{2}}{3}$ D) $\frac{1}{3} + \frac{\sqrt{2}}{3}$ E) $\frac{1}{5} + \frac{\sqrt{2}}{5}$

25. A speaker lectured to an audience for an hour. During that hour, ten percent slept through the entire lecture and twenty percent heard the entire lecture. Half of the remainder of the audience heard one-third of the lecture, and the other half heard two-thirds of the lecture. What was the average number of minutes of the lecture heard by the members of the audience?

- A) 24 B) 30 C) 33 D) 36 E) none of these

26. A pyramid has a rectangular base with an area of 100 square inches and its other four faces are equilateral triangles. What is the height, in inches, of the pyramid?
- A) $5\sqrt{2}$ B) $5\sqrt{3}$ C) 10 D) $10\sqrt{2}$ E) $10\sqrt{3}$
27. A bathroom tub will fill in 12 minutes with both faucets open and the stopper in place. With both faucets closed and the stopper removed, the tub will empty in 20 minutes. How many minutes will it take for the tub to fill if both faucets are open and the stopper removed?
- A) 30 B) 60 C) 20 D) 45 E) 15
28. The solutions to the equation $x^3 + 4x^2 + x - 2 = 0$ are -1 , A , and B .
The value of $A^2 + B^2$ is
- A) -5 B) 6 C) 13 D) 25 E) none of these
29. A two digit integer is x times the sum of its digits. The integer formed by reversing the digits of the original number is the sum of the digits of the original number multiplied by what?
- A) x B) $11 - x$ C) $9 - 2x$ D) $\frac{1}{x}$ E) none of these
30. A circle is inscribed in a square. What percent of the interior of the square is not in the circle?
- A) between 5 and 10 B) between 10 and 15 C) between 15 and 20
D) between 20 and 25 E) none of these

Answers:

1. A
2. D
3. D
4. B
5. C
6. C
7. D
8. B
9. C
10. D
11. C
12. A
13. B
14. A
15. E
16. D
17. A
18. A
19. B
20. E
21. E
22. C
23. C
24. B
25. C
26. A
27. A
28. C
29. B
30. D